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THE CALIFORNIA INSTITUTE OF TECHNOLOGY

ROBERT A. MILLIKAN, professor of physics at the University of Chicago, has been appointed director of the Norman Bridge Laboratory of Physics at the California Institute of Technology and chairman of the executive council of the institute. Dr. Millikan has for a number of years spent the winter term at the institute, but he will now give his whole time to it, beginning in October, when the new physical laboratory will be ready for occupancy.

Dr. Millikan will devote himself mainly to the development at the institute of a large and effective research laboratory of physics. The trustees, though prepared to appoint him president, were appreciative of his desire not to be burdened with the administrative duties which are usually attached to that office, and have created a new administrative board, to be called the executive council, which will combine the usual functions of the president and the executive committee of the board of trustees. This executive council will consist of six members, three from the board of trustees and three from the faculty, as follows: Robert A. Millikan, chairman; from the trustees, Arthur H. Fleming, president of the board; Henry M. Robinson, first vice-president of the board, president of the First National Bank of Los Angeles; and George E. Hale, director of the Mt. Wilson Observatory; from the faculty, in addition to Dr. Millikan, Arthur A. Noyes, director of the Gates Chemical Laboratory, and Edward C. Barrett, secretary of the institute.

Liberal provision, made possible by large gifts to the institute, has been made for the physical laboratory, for which an annual appropriation of $95,000 has been guaranteed. These funds will enable a large staff of able investigators and teachers and an unusually

complete equipment to be secured. In addition to this provision for annual support, the institute has recently received from Dr. Norman Bridge the promise of $200,000 for an extension of the physics laboratory and of $50,000 for its library.

It is also announced that the Southern California Edison Company will immediately erect at a cost of $75,000 on the campus of the California institute a high-tension laboratory where an extensive investigation on the transmission of power at high voltages will be made by the staffs of the company and of the physics and electrical engineering departments of the institute under the direction of Profesor R. A. Millikan and R. W. Sorensen, and where other scientific researches will be carried on by the professors of the institute in cooperation with the Mt. Wilson Observatory.

A large project of research work will be at once undertaken, involving the close cooperation of the Mt. Wilson Observatory, the Norman Bridge Laboratory of Physics, and the Gates Chemical Laboratory of the institute. This research project will consist in a systematic attack on the most fundamental problem of physical science to-day—that of the constitution of matter and its relation to the phenomena of radiation. Further advance in these fields is to be expected, on the one hand, largely through the utilization of the most powerful agencies, such as enormously high temperatures and pressures, high-voltage discharges and intense magnetic fields; and, on the other hand, through the active cooperation of physicists, astrophysicists, mathematicians and chemists, whose combined viewpoints, knowledge, and experimental skill will contribute. These conditions already exist in large measure at Pasadena, but the scientific staff and the experimental facilities are to be so extended that the opportunities for the investigation of this fundamental problem will be exceptional.

It is also announced that, in order to supplement the work in mathematical physics now carried on by Professor Harry Bateman, Profesor H. A. Lorentz, of the University of Leiden, will be in residence as lecturer and research associate of the institute during two months of the winter term, and that Dr. C. G. Darwin, of the Univerity of Cambridge, has been appointed professor of mathematical physics at the institute for the college year of 1922–23.

THE COURSE IN GENERAL ZOOLOGY: METHODS OF TEACHING

Professor Shull has done a signal service to the teaching of general zoology by calling attention to the defects of the one-time prevalent "type course" and to certain advantages to be gained by basing the course on general principles. The kind of course deemed best by Professor Shull is indicated in his papers in Science[1, 2] and his recent "Principles of Animal Biology"[3] and "Laboratory Directions."[3] Professor Nichols[4] has discussed the relative merits of a course in general biology as compared with separate courses in botany and zoology, and Professor Henderson[5] has made a plea for the substitution of the study of human physiology for the study of animals and plants. Professor Colton[6] has discussed aim and incentive from the standpoint of the attitude of the student toward the subject. In none of these papers, however, has much been said as to fundamental *purpose* or *method*. Professor McClung[7] in his appeal for a discussion of the general course in zoology indicated that these subjects should receive predominant attention in any effort to arrive at a satisfactory conclusion as to how the course should be given. It is to the subjects of purpose and method, and especially the latter that the writer desires to invite attention.

It would seem to be self-evident that matters of content, arrangement and method should be determined by the aim or purpose

[1] Science, December 27, 1918.
[2] Science, March 26, 1920.
[3] New York, McGraw-Hill Book Co.
[4] Science, December 5, 1919.
[5] Science, January 16, 1920.
[6] Science, April 16, 1920.
[7] Science, April 11, 1919.

for which the course is given. To a certain degree, also, the purpose should be influenced by the character and prospective careers of the students taking the course.

With regard to the latter consideration it may be assumed that in a majority of college classes in general zoology there are roughly two groups, one composed of those who will take no other courses in the subject but who are destined to enter upon a great variety of walks of life, and the other composed of those who will pursue the subject further, to prepare themselves to become physicians; teachers in high schools, colleges and universities; investigators or other kind of professional workers.

It may properly be asked whether it is possible to give a single course which will satisfy the needs of these different groups of students. The writer believes that an affirmative answer can be given. The general purposes in teaching zoology are necessarily identical with the aims of all education, namely, to make life more worth while for those who attend the schools by developing and training their mental faculties and by extending their knowledge of themselves and the world in which they live. The purposes thus include giving information of a valuable nature, and giving training. Nearly all of the scientific work being done in the world to-day is accomplished by persons trained in scientific methods; and it is the trained mind and hand that employers everywhere are demanding. Consequently training of the right kind should be of value to all classes of students while information or content may be varied to meet the more special needs of each class.

As to the nature of the training that should be given Professor Nichols has given an admirable statement:[4]

> The value to the student of biology or zoology as a cultural study lies quite as much in methods acquired and in facts observed as it does in information received. First and foremost the student should be taught to be careful in his technique, to be precise in his observation, to be thorough in his attention to details, to be keen in finding things for himself, to be accurate in his conclusions.

To these may be added—to make effective use of the English language. Surely no student, no matter how he may be planning his future, could fail to profit by a course which gave training in the qualities enumerated.

Is it not therefore necessary to select with care the method of teaching which will give the best results in accomplishing the kind of training indicated? The too-prevalent method of confirmation or verification, when used exclusively or combined with purely informative methods, can scarcely give the desired results. The so-called scientific method, involving so far as is practicable the method of discovery, must be employed if training for individual initiative or independence of thought is to be acquired. And unless the student does learn to think independently he can never take the leadership in the community for which his education should be his preparation.

The scientific method has been called the method of common sense extended and systematized. It involves the inductive process of drawing conclusions from observed facts. It is not only the basic method for all scientific work but it is applicable to almost every field of human activity requiring thought and judgment. In applying it there is assumed a purpose or goal to be reached or problem to be solved which is stated or described as clearly as possible. Then observations are made which may or may not be based on experiment. The observations are made with great care and as extensive as time and material will permit. The observations are recorded in some permanent and convenient form by the use of notes, drawings, models, charts, graphs, maps, or photographs, depending upon the nature of the material. The data thus secured are correlated and coordinated (synthesized) so that a conclusion may be drawn. Should not every course in a science give training in the scientific method?

As a further amplification of the views of the writer with regard to the use of this method in the course in general zoology, extensive references will be made to the course given at the University of Pennsylvania since the plans for this illustrate in a concrete way

the ideas that the writer desires to convey. With reference to this course it should be said that it was established upon the basis of "general principles" about twenty years ago when Professor Conklin was head of the department. The instructors concerned are therefore in hearty accord with Professor Shull's efforts to extend the employment of such a plan. For the past few years also a serious effort has been made to apply the scientific method throughout the part of the course devoted to laboratory studies and the results have more than justified the efforts in this direction. The laboratory work, occupying more than two thirds of the time devoted to the course is, consequently, presented to the student in the form of a series of problems framed as far as is practicable upon the method outlined above.

In deciding how the course should begin a number of purposes have been kept in mind. An effort has been made to lessen as much as possible the difficulties that students have in getting started on a new subject under entirely novel conditions. Contrary to the rather widespread practise of beginning with the cell or a protozoon, an animal is used at the start which is large enough to be seen without special equipment, since to get acquainted with the compound microscope constitutes no small task in itself. Another reason for taking a larger animal is that it is much more likely to fall within the range of the student's experience, and, further, since the student is accustomed to look at animals as individual entities, it is more desirable to present an entire animal than any part of it such as a cell or tissue. It is an open question whether it is better pedagogy to begin with the simple (cell—protozoa) and proceed to the complex (entire animal—metazoa) or to proceed from the more familiar (entire animal) to the less familiar (tissues and cells). As a result of their teaching experience the instructors giving this course have adopted the latter alternative. They are furthermore in agreement with Professor Nichols when he says:[4]

> Let the student learn to be analytic before he attempts synthesis.

In choosing the first animal it has also seemed desirable to select one which is definite in its morphological characters and complex enough to afford a good test of the student's powers of observation.

With the foregoing considerations in mind an Arthropod, such as a grasshopper or crayfish, has frequently been chosen and used with much success. At the beginning the student is asked to study carefully a specimen of the chosen animal and to make two pictures of it; a word picture, thus permitting him to use his most familiar tool of expression, his language; second, a picture in the form of a drawing. He is asked to organize his description carefully, make an outline of it and then write it out, using the best English at his command. He is asked to compare his two pictures and decide which is the more accurate: this is the problem set for him to solve. Almost without exception the student perceives that the drawing furnishes a much more accurate picture of the animal than does his description and thus some of the objections that students are accustomed to make to the requirement of drawings are met and disarmed at the very outset.

Then through a series of problems the student is asked to determine in an analytical way the external anatomy of the animal, recording his observations in the form of fully labelled drawings. At the end he is asked to integrate his information into an essay upon the specimen as a whole animal.

This study is followed by an exercise on classification most of the material for which the student collects for himself. Next a vertebrate, such as a frog, is introduced to give a better basis for the subject of general physiology, which is presented primarily from the standpoint of human physiology, but also with reference to the animal which is being dissected. The student is thus introduced to the more general morphological and physiological characteristics of living things, is brought to see the application of these principles to his own body and mind, and perceives the funda-

mental similarities between himself and the lower organisms, the latter represented by his laboratory specimens.

Next the student is given an "unknown" vertebrate to study. For the most part the student is placed on his own responsibility and judgment in handling the new specimen, his problem being to determine and record facts in the best possible manner, and to make intelligible to any one unfamiliar with it, the appearance and organization of the new animal. Having been given a method with the earlier specimen he is expected to apply it to the second. A large majority of the students give a ready response to this appeal to their individual initiative and to the opportunity for making discoveries for themselves. In some cases an interest which may have been lagging is stimulated into renewed and sustained activity.

The compound microscope is next introduced by a special problem on the use of the microscope, and this is followed by the study of cells and tissues. Then follow in succession studies on embryology, cell division, maturation and fertilization, with especial attention to the behavior of the chromosomes. But since the complex behavior of the chromosomes in mitosis, maturation, and fertilization is most satisfactorily explained as the mechanism for the behavior of mendelian factors, the subject of heredity, and especially mendelism, is considered along with these morphological studies. A book on heredity, such as that of Conklin[8] or that of Guyer[9] is read by the student and he also carries out a breeding experiment with *Drosophila*.

Next an evolutionary series is presented consisting of representatives of the protozoa, cœlenterates, flat worms and annelids, followed by other studies illustrating evolution. In addition to furnishing evidences for organic evolution, the series is made to illustrate a variety of biological principles, further details about which will, for the sake of brevity, be omitted here.

These objective studies are handled in the form of problems based upon the scientific method previously outlined. As the course develops and the student gains in experience he is placed more and more on his own responsibility as to methods of procedure and record, thus permitting him to apply the lessons in method that have been learned. In addition to training in method, the student gains through these studies much of the information that he is supposed to acquire, and gains it in a way that will make it of the most value and permanency for him. Additional information is conveyed through lectures, quizzes, and assigned readings, so selected and arranged as to emphasize general principles and to contribute to the "unity and balance" of the course.

Since the scientific method is more time-consuming than other methods, its use imposes rather definite limitations upon the amount of ground which may be covered in any given time. But the results have been so much more satisfactory than those secured by other methods that the instructors giving the course feel that its use is thoroughly justified.

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[8] "Heredity and Environment," Princeton, Princeton University Press.

[9] "Being Well Born," Indianapolis, Bobbs-Merrill Co.

LOUIS ALBERT FISCHER

LOUIS ALBERT FISCHER, physicist and chief of the Division of Weights and Measures of the United States Bureau of Standards, died at his home in Washington on July 25, aged fifty-seven years. Early in life he joined the old weights and measures office of the U. S. Coast and Geodetic Survey. During this period he compared the standards of length in the custody of the national government with the standards submitted for test by manufacturers, educational institutions, and the various state weights and measures bureaus. The duties of this position also included the standardization of weights, the ordinary weights of commerce as well as the weights

used in the most precise work of the analytical chemist, and the standardization of thermometers and of surveyors' tapes used in precise geodetic measurements. This early work laid the foundation for the establishment of the National Bureau of Standards in 1901, in the creation of which he took a conspicuous part. At the organization of that Bureau, he was chosen as chief of the Division of Weights and Measures, a position which he has since filled with distinguished honor. In a life, crowded with important administrative responsibilities, he had, nevertheless, found opportunity to carry on scientific researches which have won for him recognition as one of the leading American metrologists. He built up in the Bureau of Standards a strong division of weights and measures, from which have come many valuable scientific and technical contributions. Owing to the limitation of space, I can only refer to a few of these here, but many will recall the investigations and papers relating to the densities of aqueous alcoholic solutions, the standardization of chemical glassware, the thermal expansivities of metals, alloys, and dental amalgams, the testing of clinical thermometers, the comparison of the national prototype meter with the international meter, the testing of watches, model laws for state weights and measures services, specifications for railroad track scales, the standardization of screw threads, gauges, etc. In many of these papers he shared the honors of authorship and all of them bear the impress of his inspiring and forceful leadership.

In 1905 Fischer organized the Annual Conference of Weights and Measures of the United States and he has since been the secretary of that organization which includes national, state, and municipal officials and others interested in the promotion of wise and uniform legislation and regulations relating to weights and measures. His advice and opinions have been sought by officials dealing with these matters in every state in the Union and probably no man in this country has had so profound and far reaching an influence in all matters appertaining to weights and measures in the past decade. He has for many years been annually designated by the president to serve on the commission entrusted with the responsibility of testing the "fineness" of the coinage, and he has, on numerous occasions, been invited to testify before Congressional Committees on Coinage, Weights and Measures.

Shortly after the entrance of this country into the World War, Fischer was chosen and commissioned a major in the Ordnance Department of the U. S. Army and was placed in responsible charge of the important section of gauge design. Here again his remarkable abilities as an administrator and organizer, combined with his tireless energy, enabled him to make a highly efficient organization out of a hastily assembled personnel, that was necessarily built up on the basis of quick but discriminating judgment. The value to the nation of his broad scientific grasp of his subject, of his engineering and technical training, of his unerring judgment, and of his untiring devotion to duty in this position can hardly be overestimated.

Fischer was a graduate of the George Washington University, a member of the American Physical Society, of the Physical Society of France, of the American Society of Mechanical Engineers, of the Washington Academy of Sciences; member and past-president of the Philosophical Society of Washington, and fellow of the American Association for the Advancement of Science. For many years he has been an active member of the Cosmos Club and of the Columbia Country Club.

He was a lover of clean and manly sports and achieved distinction as an athlete. In his early manhood he was a noted oarsman, winning many honors for the Potomac and Analostan Boat Clubs in local and national regattas. Rather late in life he took up tennis and soon won recognition as one of the leading tennis players of Washington, representing the Bachelors', the Dumbarton, and the Columbia Country Clubs in many local, intercity, and interstate tournaments.

Fischer, like his distinguished colleague Rosa, who died only a few weeks before, be-

longs to that group of public officials, growing increasingly prominent in the scientific and technical services of the government, who willingly forego the rewards and comforts that their brilliant abilities might easily win for them in other walks of life, in order that they may follow the highest ideals of their profession. In the example of his splendid life, in the influence of his wise and unerring judgment and counsel, and in his splendid idealism, Fischer will continue to live on, in the years that stretch out before, in the memory of those whose lives were enriched by his friendship.

C. W. WAIDNER

SCIENTIFIC EVENTS

THE BRITISH NATIONAL PHYSICAL LABORATORY

THE report of The British National Physical Laboratory for 1920, which was recently issued, gives a survey of the work carried out in the various departments during that year, and also a statement of the program for 1921–22.

From the abstract in the London *Times* we learn that in regard to testing work, the charges for which have been revised owing to increased cost, the number of tests made in some departments was considerably smaller than in the preceding year and even than in the year before the war, though in others an increase is recorded. Of clinical thermometers no fewer than 1,598,100 were tested, and it is interesting that there has been a steady improvement in the quality of the instruments since the introduction of the order requiring them to be submitted to test.

In spite of the falling off in the routine work of certain sections, the activities of the laboratory continue to grow, and the demands upon it are likely to be increased in consequence of the steps taken by the government for the establishment of coordinating research boards for physics, chemistry, engineering, and radio research. The Radio Research Board has drawn up and approved a scheme of research to be carried out at the laboratory, and the Physics Research Board has also indicated certain lines of research which it is considered desirable the laboratory should take up. Some additions to the buildings have been authorized and others are under consideration. The space available for extension is, however, very limited, and accordingly measures have been taken to secure land for building purposes immediately adjoining the laboratory grounds.

As usual, in addition to researches of a general character, the laboratory has in hand various special investigations for government departments and other bodies. The Photometry Divison, for example, has undertaken experiments on ships' navigation lamps for the Board of Trade, on miners' lamps for the Home Office, and on motor-car head lamps for the Ministry of Transport. It is assisting the Office of Works in connection with the lighting of government offices, museums, and other buildings. Experiments have been made for the purpose of securing adequate illumination on the walls at the National Gallery, while avoiding direct sunlight and of diminishing as far as possible reflection of objects and people in the glass covering the pictures. Measurements in the Houses of Parliament have shown that, especially in the House of Commons, the illumination is very low—less on the average than the equivalent of one candle at a foot, whereas it is usually considered that three or four times as much should be provided for the easy reading of such matter as manuscript notes.

RESOLUTIONS OF THE MEDICAL BOARD OF THE JOHNS HOPKINS HOSPITAL

THE resolutions limiting the fees of surgeons operating at the Johns Hopkins Hospital to $1,000 and fees for hospital visits to $35 weekly, recently passed by the trustees on the recommendation of the Medical Board, are as follows:

WHEREAS, the trustees of the Johns Hopkins Hospital desire that all patients may leave the hospital feeling that they have received not only proper professional, nursing and administrative service, but also that they have been dealt with fairly in every particular, including charges for medical and surgical service; and

WHEREAS, the trustees believe that the members of the staff likewise desire this result and will continue to cooperate in carrying out the policy of the hospital as considered for the best interest of the patients and the hospital; therefore, be it

Resolved, That the following regulations be adopted:

1. That members of the staff shall bring promptly to the attention of the director of the hospital any conditions or circumstances which they feel justify criticism and should be corrected, also any just complaints uttered by their patients or the friends and relatives of patients, applying either to the professional service or to the management.

2. That all fees to be charged for services rendered any patients in the private rooms of the Hospital shall be subject to the jurisdiction of the committee on fees, and shall in no case exceed the amounts stated below, except where the consent of said committee shall have been obtained; it being understood, however, that all fees charged shall in no case impose a hardship upon those responsible for their payment and shall be arranged in advance of admission wherever possible, or as soon thereafter as possible.

(*a*) Professional service by physicians, $35 per week, which includes at least three visits by the patient's physician.

(*b*) Consultation fees, $25.

(*c*) Maximum fee for major operation, $1,000.

(*d*) No consultation fee shall be charged patients entering the public wards when the examination has been made anywhere in the hospital.

3. That not more than 10 rooms shall be at the disposal of any one member of the staff at one time if the private rooms are in demand by other members of the staff having the same privilege.

THE HUNAN-YALE COLLEGE OF MEDICINE

ON June 18, eleven Chinese young men received their M.D. degrees at the Hunan-Yale College of Medicine at Changsha, China. This medical college is part of the educational enterprise known as "Yale-in-China," the first of the American institutions overseas to be launched by and to bear the name of the alma mater.

In 1900, Hunan Province was closed to foreigners. Its wealth of resource, its educational traditions, the caliber of its men, were all known; but no Westerner was desired inside. On July 28, 1903, a treaty threw its capital, Changsha, open to the world. Soon after, it was decided to establish there the educational work of Yale University.

Starting with a class of high-school freshmen in 1906, Yale-in-China now includes a College of Arts and Sciences, authorized by the Connecticut legislature to grant degrees; a Preparatory School; a modern medical college, with associated hospital and school of nursing. The student enrollment is nearly 400.

In 1913 a modern hospital was promised by a Yale graduate; and the assurance of this gift so stimulated the Chinese of this interior capital city that they formed a society for the promotion of medical education. A joint local board now administers all the medical work, and the Hunan government makes an annual grant of $50,000 silver. In addition, generous grants are received from the China Medical Board of the Rockefeller Foundation and from the Commonwealth Fund.

The medical college requires two years of pre-medical science laboratory work, and grants the medical degree only after five years of study, the fifth being largely a hospital year.

The graduation in June was the first in the medical college and was a memorable occasion, large numbers of Chinese officials being present in recognition of the fact that this institution stands conspicuous in China as representing a true Chinese and American cooperation.

The Medical Advisory Board includes Dr. W. B. James, chairman, Dr. W. H. Welch, Dr. John Howland, Dr. S. W. Lambert, Dr. F. T. Murphy, Dr. George Blumer, Dr. Harvey Cushing, Dr. R. P. Strong and Dr. A. D. Bevan.

A NEW MUSEUM AT CASTINE, MAINE

NEAR the site of the first French settlement (1611) at Castine, a museum is being erected. It is 75 feet in length, about 35 feet deep and is flanked by a terrace overlooking Castine Bay. The construction is fireproof and the building will have objects of historical

importance as well as a large collection of the artifacts, utensils, weapons, etc., of prehitoric man here and abroad.

Dr. J. Howard Wilson and his mother, Mrs. J. B. Wilson, are the donors. Rather than place his important exhibits in some of the larger museums, Dr. Wilson preferred to give the citizens of Castine this modern structure and interest them in the beginnings of human culture as well as preserve their own priceless historical relics. It is quite fitting that the building-lot adjoins the famous Fort Pentagoet site.

The building and endowment of local museums should be encouraged, since by that means knowledge is more generally disseminated than through the larger museums.

By November the structure will be completed, and it is proposed to have it dedicated some time next spring. Dr. Wilson's collections total many thousands, and there are numerous French, English and colonial objects in Castine which are available for exhibition.

SCIENTIFIC NOTES AND NEWS

WALTER G. CAMPBELL, assistant chief of the Bureau of Chemistry since 1916, has been appointed acting chief to fill the place of Dr. Carl L. Alsberg, who resigned to become one of the directors of the Institute for Food Research at Stanford University. Dr. W. W. Skinner, chief of the water and beverage laboratory of the bureau since 1908, has been designated as assistant chief.

DR. ROSCOE THATCHER, who succeeds Dr. W. H. Jordan as director of the New York State Agricultural Experiment Station, has taken up his work at Geneva.

DRS. GEORGE DOCK, St. Louis; Otto Folin, Boston; and Ludvig Hektoen, Chicago, have accepted appointments as consultants to the National Pathological Laboratories to advise on methods used, interpretation of results and ethical policies.

DAVID PRESCOTT BARROWS, president of the University of California, has been appointed a member of the National Research Council for a period of three years in the Division of States Relations.

WE learn from *Nature* that at the meeting of the Royal Society of Edinburgh on July 4 the following were elected honorary fellows: —*British:* William Henry Perkin, Sir Ronald Ross, Sir Ernest Rutherford and Sir Jethro J. H. Teall. *Foreign:* Reginald Aldworth Daly (Cambridge), Johan Hjort (Bergen), Charles Louis Alphonse Laveran (Paris), Heike Kamerlingh Onnes (Leyden), and Salvatore Pincherle (Bologna).

ON June 22 a portrait of Sir Napier Shaw, painted by W. W. Russell, was presented to him by the staff of the Meteorological Office, South Kensington, for preservation in the office. A copy of the portrait was presented to Lady Shaw.

AN International Hydrographic Bureau has been established at Monaco, with the following directors: Vice-Admiral Sir John Parry (Great Britain), Captain Phaff (Netherlands), and Captain Muller (Norway). The secretary is Captain Spicer-Simson (Great Britain).

COLONEL THOMAS SINCLAIR, professor of surgery in Queen's College, Belfast, is among the twenty-four members elected to the senate of the Parliament of Northern Ireland, and Sir Thomas Joseph Stafford, late medical commissioner, Local Government Board, Ireland, is elected to the senate for the Southern Parliament.

A FRENCH society "for encouragement *du bien,*" recently awarded a civic crown to the Institut Pasteur at Paris, and presented it to Dr. Roux as the representative of that institute.

THE trustees of the Beit Fellowships for Scientific Research, endowed in 1913 by Sir Otto Beit, to promote the advancement of science by means of research, have elected to fellowships Messrs. H. L. Riley and W. A. P. Challenor. Both will carry out research at the Imperial College of Science and Technology at South Kensington.

PROFESSOR AND MRS. E. W. D. HOLWAY, of the University of Minnesota, sailed from New

York City on July 23, for Rio de Janeiro, Brazil. They have planned a two-years' trip for the collection of plants and especially the rusts. They expect to cross the Andes early in the coming year, and spend the remainder of the time on the west coast.

Dr. Frank T. McFarland, who has been spending his sabbatical leave at the University of Wisconsin investigating the relationships of the various claviceps, has returned to the University of Kentucky as head of the Department of Botany.

Professor George F. Sykes, of the department of zoology and physiology in the Oregon State College, will spend a sabbatical year in travel, study and literary work, during which his address will be Warren, Rhode Island.

Dr. Frederick Starr, of the University of Chicago, is giving a series of illustrated lectures at the university as follows: August 5, "Aztec Mexico"; August 12, "Modern Mexico"; and August 19, "Mexico to-day."

Dr. Winthrop E. Stone, since 1900 president of Purdue University, and previously professor of chemistry, fell from a cliff near the summit of Mt. Eanon, Alberta, on July 16, and was instantly killed. Dr. and Mrs. Stone had nearly completed the initial ascent of the mountain when the accident occurred.

Professor Alfred Monroe Kenyon, head of the mathematical department of Purdue University, died suddenly at Ashland, Ohio, on July 27, while returning to Lafayette, Ind., by train after attending the funeral of his mother. Professor Kenyon was 52 years old.

Charles Barney Cory, curator of zoology in the Field Museum of Natural History, died on July 29, at the age of 64 years. Mr. Cory was one of the founders and a past president of the American Ornithologists' Union, a member of many societies, and widely known for his ornithological writings.

Charles Howard Royce, extension professor of animal husbandry at the New York State College of Agriculture, Cornell University, died on August 5, as a result of injuries suffered in a fall from a silo on his farm here on July 11.

Edmond Perrier, director of the Museum of Natural History in Paris, died on August 1, aged seventy-seven years.

Professor Kraepelin, of Munich, announces that the Institute for Research in Psychiatry, of which he is director, has received gifts and bequests this year totaling over 1,500,000 marks, and the collections and the library have also been notably enriched by gifts.

According to an announcement made by the secretary of the New York Association for Medical Education, Dr. Otto von Huffman, the Carnegie Foundation has offered to make a donation of $12,000 to the association on condition that the medical profession shall raise $3,000. The raising of this sum will enable the association to continue its activities which have been curtailed of late because of lack of funds. This association was organized two years ago to collect information in regard to postgraduate medical instruction and to develop such courses.

Instructions have been issued to the representatives of the Bureau of Fisheries on the Pribilof Islands authorizing the taking of 30,000 fur-seal skins on both islands during the calendar year 1921. Tentative divisions by classes for the killings on the two islands are as follows: St. Paul, 22,100 three-year-olds, 3,000 four-year-olds, and 600 five-year-olds; and St. George, 2,750 three-year-olds, 450 four-year-olds, and 100 five-year-olds. As the season progresses some readjustments as to numbers of the various classes may become desirable as the result of observations on the ground. The regular summer sealing season ended on August 5, instead of continuing until August 10, as heretofore.

An interdepartmental conference was held on July 25, in the Interior Department building, Washington, D. C., to discuss the status of patients arising within the government service, the intention being to formulate a coordination of the views now held in the various bureaus and departments upon this subject, and to work out some concerted method of procedure for handling the patients here considered. Mr. E. C. Finney, assistant

secretary of the interior, presided at the conference, which was held at the suggestion of the secretary of the interior and was composed of representatives from the various executive departments. After a general discussion of the subject under debate, two committees were appointed to go into the matter further and to report to a similar conference to be held at some future date. A committee of five is to consider in detail ways and means for the coordination and procedure work above suggested, and a committee of three is to develop a plan to provide a general clearing house for the dissemination of information among the several executive departments with respect to licenses, shop rights, and titles, which the Government has acquired, or may acquire with respect to patients.

ANNOUNCEMENT is made that it is the policy of the War Department to encourage the development of military inventions by officers, enlisted men and civil employees. In consideration of assistance to be given by the department in the issue of patents, it will require of inventors a license to manufacture and use their inventions for governmental purposes, thereby reserving to the patentee complete freedom and ownership of the patent in its commercial applications. In special cases of inventions of great military importance, however, provision is made for exclusive government ownership and the utmost secrecy.

THE New England Intercollegiate Geological Excursion will be held on October 14 and 15 in the vicinity of Attleboro, Massachusetts, under the leadership of Professor Jay B. Woodworth of Harvard University.

UNIVERSITY AND EDUCATIONAL NOTES

AT a recent meeting of the board of regents of the University of Oregon, it was decided to place contracts immediately for the construction of the new medical school building in Portland. It was also decided to name the medical school building after the late Dr. Robert C. Yenny.

ST. LOUIS UNIVERSITY is erecting a new building, 50 x 200 ft., three stories high, as an extension to the medical school. Accommodations will be afforded for the library, reading room, administration offices and the laboratories for physiology, pharmacology and histology. In addition to this the old building is being remodeled so as to give more adequate accommodations to the other departments.

BY the will of Seymour T. Coman, of Chicago, the residue of his estate is bequeathed to the University of Chicago for scientific research with special reference to the cause, prevention, and cure of disease. The fund is to be known as the Seymour Coman Research Fund.

AT the Harvard Medical School Dr. Alexander Forbes has been promoted to be associate professor of physiology, and Dr. George Cheever Shattuck to be assistant professor of tropical medicine for a one-year term.

MAJOR HUGO DIEMER, formerly professor of industrial engineering at Pennsylvania State College and later personnel superintendent at the Winchester Repeating Arms Co., New Haven, has been appointed director of the industrial management division of LaSalle Extension University, Chicago, Ill. The division includes the resident and correspondence instruction in industrial management efficiency, modern foremanship and production methods and personnel administration, as well as the consulting service in each of these departments.

DR. ARTHUR J. TIEJE, who received his doctorate from the University of Minnesota in 1920, has been appointed assistant professor of geology at the University of Colorado, and assistant geologist on the Colorado Geological Survey.

PROFESSOR MAURICE DEWULF, formerly of the University of Louvain and sometime teacher in Harvard and Lowell lecturer, has accepted a permanent appointment as professor of philosophy at Harvard.

DISCUSSION AND CORRESPONDENCE

"DENUDATION," "EROSION," "CORROSION" AND "CORRASION"

THE recent article by Professor M. H. Bissell[1] on the use of the terms "denudation," "erosion," "corrosion" and "corrasion" expresses a need which is felt by most instructors of elementary classes in geology and physiography. In the opinion of the writer the confusion of terms is attendant on a confusion of ideas concerning three very essential topics discussed in any elementary class, namely, weathering, denudation, and deposition.

The geologic agents of denudation and deposition are practically identical. Hence it is logical to discuss the denudational and depositional work of the wind, running water, underground water, the ocean, ice, and gravity. It seems to the writer, however, that the practise of placing a discussion of weathering in a chapter entitled "The work of the atmosphere" is very confusing. The agents of weathering are quite distinct from those of denudation and deposition, and require separate treatment. It is very difficult to show the connection between the work of the atmosphere and exfoliation. It is poor physics to teach that the expansion and contraction of rocks is due to the atmosphere.

The writer would define weathering as the alteration of rocks rendering them liable to transportation by the dynamic forces having their origin near the surface of the earth. Wind, water, ice, and gravity can not transport bed-rock. But when bed-rock is broken down by the chemical and mechanical activity of weathering, its particles may be transported.

In a similar way, denudation might be defined as the removal of the products of rock weathering by the dynamic forces having their origin near the earth's surface. The process involves the lowering of the earth's surface by the combined actions of erosion and transportation. Erosion may be subdivided into two processes: (1) the mechanical wearing away of rocks (abrasion) by wind, running water, ice, and gravity; and (2) the chemical loss (corrosion) due to agents present in passing streams of water and air. The central idea expressed by the term "denudation" should involve the erosion and transportation of rock debris from its source to a position below baselevel.

The word "corrasion" appears to be so similar in usage to the term "erosion" that it should be discarded in favor of the commoner term.

The writer believes that the average geologist has not departed very far from the root significance of the terms discussed by Professor Bissell. The development of the term "weathering," however, has outrun its original meaning, and processes are included which are not connected with atmospheric action.

A diagrammatic outline for class discussion of these topics might be the following.

- **Weathering.**
  - Water.
    - Mechanical (frost)
    - Chemical (hydration, oxidation, etc.)
  - Heat and cold, mechanical (exfoliation)
  - Atmospheric gases, chemical (oxidation, carbonization, etc.)
  - Plants
    - Mechanical (root growth)
    - Chemical (acids from roots and decay)
  - Animals.
    - Mechanical (digging, burrowing)
    - Chemical (acids from decay and excreta)
- **Denudation and Deposition...**
  - Wind: Erosion, transportation, deposition
  - Running Water: Erosion, transportation, deposition
  - Underground Water: Erosion, transportation, deposition
  - Ice: Erosion, transportation, deposition
  - Gravity: Erosion, transportation, deposition

It may appear that the chemical activity of water in weathering, and of running water in denudation, are one and the same thing, but it

[1] SCIENCE, April 29, 1921.

would appear to the writer that a distinction can be drawn between the static agent on the one hand, and the moving agent on the other.

WILBUR G. FOYE

WESLEYAN UNIVERSITY

A POSSIBLE FACTOR IN THE INCREASING INCIDENCE OF GOITER

IN my surveys of industrial hygiene I have noted that at some of the salt works in Ohio, where the material is obtained from deep wells (which in pioneer days were widely known springs, and the gathering points of men and animals), bromine, and a trace of iodine, are separated out of the purified product, sodium chloride, and bromine sold as a by-product. I suspect that in inland countries, Nature's chief source of iodine has been in connection with these salt springs, wells, and "licks," and that perhaps this change to a deep source of salt and this purification has resulted in the quite complete absence of iodine from our daily condiment when obtained from inland manufacturers, that is, in package or carton through the avenues of commerce.

It is well known that sea salt, some sea foods, and sea growths contain iodine. Also there is only a limited amount of goiter among dwellers along the seas. Furthermore, in former times a considerable part of the salt used has been sea salt, simply crystallized, and not necessarily pure sodium chloride separated from the other halogen salts.

At first this theory does not seem plausible in connection with the historical incidence of goiter, cretinism, and other manifestations of hypo-thyroidism, noted in the Alps and associated mountain regions, wherein are located some of the largest salt mines in the world. However, Molinari in his "Inorganic Chemistry," as translated by Dr. Ernest Fielmann (1912), takes occasion to explain that while these great salt beds were originally naturally deposited from sea waters, they have had the composition of the deposits very materially changed during the ages, through the varying solubilities of the halogen compounds (sodium iodide being particularly soluble and therefore among the first to be washed out through the influence of percolating waters). Hence perhaps inhabitants of these regions, getting their salt from these localities, have been bereft of the associated iodine component so essential to the human economy.

As is well known, Marine and Kimball published remarkable effects of the administration of a few grains of sodium iodide several times a year to school children as a prophylaxis in goiter.[1] After communication with two or three authorities I am convinced that this suggestion concerning goiter has not been heretofore considered. Also in an investigation of literature at hand, I have been unable to find that any consideration has been given to the influence of a condiment composed of whole sea salts upon goitrous conditions. Should any one be so informed, I shall be pleased to hear from him, inasmuch as I have determined to spend a little time this summer in investigating the subject from the industrial end.

E. R. HAYHURST

OHIO STATE DEPARTMENT OF HEALTH,
COLUMBUS, OHIO

THE SOCIAL ASPECTS OF COUNTRY PLANNING

FOLLOWING in the wake of city planning now comes country planning. As the face of the country differs from the face of the city, so country planning in some respects will differ from city planning. The social aspects of the planning idea as applied to country living conditions, are so important that a study of these aspects should rank as a sociological contribution of the first order.

Such a study is under way in the Division of Farm Life Studies, Office of Farm Management and Farm Economics, U. S. Department of Agriculture. The first step in the study is finding out the location of a few of the best instances or examples of outdoor country art and country planning in the United States—especially instances arising from the initiative of farm or village populations. The next step is to obtain a description and history of each from the person who has been connected with, or has close personal

[1] *Jour. Amer. Med. Assoc.*, Vol. 71, No. 26, pp. 2155, Dec., 1918.

knowledge of, the enterprise. This fund of information will give a basis for studying the social effects upon the farm population itself, and of estimating the special value of a policy of country planning in the development of country life in America.

The kinds of examples of country planning which the division of Farm Life Studies is particularly desirous of locating are as follows: Country parks (not State or Federal) for country people, outside villages and cities; public reserves in the country, that is, spots of natural beauty or of historic interest reserved for public use either through private benefaction or by local government; "gateways" to town or village from the farming country—that is, improved fringes of towns and villages, where highways lead from the farms planned and maintained through private or public means; colonization planning by land companies, which provides beforehand for better adjustments of rural community life; special outdoor art features, such as may be illustrated by certain farm athletic fields, farm roadside tree plantings, country bulletin boards, country cemeteries, community buildings, detachment of farm houses from farm work by screening effects.

The technical landscaping phases of country planning are promoted by the Bureau of Plant Industry, U. S. Department of Agriculture. The technical side of country planning, highly important indeed in its place, is not, however, a subject of inquiry in the present study. On the other hand, the human conditions and motives which lead to outdoor art improvements or which on the other hand, prevent or retard such improvements among American farm population groups, are the immediate aim of the study. There are presumably inducements to a country art movement not now generally recognized. There are possibly social values in country art which may become convincing to farmers when once analyzed. The result will doubtless increase the demand in farm communities for the outdoor art technician.

It will help to forward this work if any one conversant with the particulars of any outstanding instance of the foregoing phases of outdoor country art, will send some account, and photograph or other pictorial representation of the same, to the undersigned.

C. J. Gilpin
U. S. Department of Agriculture

QUOTATIONS

CUSTOMS LEGISLATION IN ENGLAND

So far as makers of scientific apparatus are concerned, we believe they are not satisfied with import duties, and want prohibition of import for a time, with permits to import in special cases. Many consumers have stated their preference for a system of subsidies to enable prices to be low enough to compete with foreign goods. Such a scheme naturally offers difficultes, and there would need to be assurance that efforts at improvement are being made. There seems to be no reasonable objection to the price being made as nearly as possible equal to that of the foreign article, so that the competition should become one of quality. The bill, however, will probably be passed, although it may still be possible to insert provisions to enable free import to recognized scientific institutions. Such permits must be of a general character, not requiring renewal, and not demanding the intervention of the customs or other government department. No special licenses for individual cases would be satisfactory.

How obstructive to scientific progress the customs regulations may be is shown by letters that have appeared in these columns. The question of books is a very serious one. Incidentally, reference may be made to the increasing difficulty of publication of scientific papers, which seems to be greater in England than in other countries. But here again what is wanted is a general fall in prices, and this can be brought about only by a return to normal trade relations throughout the world.

Much stress was laid by certain speakers in the House of Commons on the necessity of our industries as a national insurance in case of future war. The only remark that need be made in this place is that the most important matter is to keep abreast of scientific work in other countries. Restriction of research is

likely to do more harm than the more or less ineffective artificial protection of a few industries would do good. It is to be hoped, therefore, that institutions in which such scientific research is carried on will be placed beyond the effect of the new restrictions on import.—*Nature.*

SPECIAL ARTICLES

THE PRACTICAL SIGNIFICANCE OF THE REVOLUTION OF THE EMBRYO IN APHID EGGS

IN 1916 W. F. Turner[1] and the writer published a paper on the green apple aphis, in which certain studies on the embryology of the species were reported. Studies on other species have since been completed and it seems now worth while to point out the important bearing that certain phases of the embryonic development have on the hatching of the egg under varying conditions. This seems especially urgent from the viewpoint of control in the egg stage.

As pointed out by Baker and Turner, the egg envelopes in the three common apple species, *pomi, malifoliæ* and *prunifoliæ* (*avenæ* of American authors) are two in number, the chorion which is thick and glossy black in color and the vitelline membrane which is delicate and transparent. At the time of deposition the egg is embedded by the female in a viscid material which serves to hold it in place on the twigs. This soon hardens and firmly fastens the egg in its location. This material covers irregularly all eggs and serves not only to cement them to the twigs but also as a protection for the chorion during the winter. It no doubt corresponds, in the Aphiinæ to the waxen coating with which the females of the Eriosomatinæ cover their eggs. A somewhat comparable condition is met with in other insects in which a glutinous cap covers the micropyle-area and may extend as an envelope over the greater part or even the entire egg.

The eggs of all three species when laid are of a somewhat greenish color and this changes ultimately to the glossy black of the winter-ing egg. This change in color coincides with preliminary embryonic development. This usually occupies about five day's time. Eggs which are infertile or in other ways abnormal do not change color in the usual way. In fact most infertile eggs are not of the normal green color when laid but have an orange or brownish tinge which may darken with age.

One of the most interesting phases in the development of these aphids is the resting stage of the embryo. All eggs, no matter whether laid early or late, reach this same stage for wintering. This is the normal dormant condition. The embryo lies in the center of the egg with its cephalic portion toward the posterior pole. The caudal half of the abdomen is reflexed dorsad in such a manner as to include the ovarian yolk. Segmentation is well marked and the formation of the appendages has begun. The stomatodeum and proctodeum are present while the formation of the mesenteron has begun. The genital rudiments are separated into two groups but the ovarian yolk is not yet divided and at the posterior pole lies the polar organ.

In this condition the embryo, especially of *pomi* and *malifoliæ,* remains until early spring and it must remain in this condition throughout the winter until normal growth is resumed. Attempts to force the eggs to their spring development are without success.

In the early spring development is resumed. This takes place in the vicinity of Washington, about the middle of March with *pomi* and *malifoliæ.* This development is accompanied by a movement of the embryo through the yolk toward the posterior pole until that portion of the amnion which lies above the head comes in contact with the serosa at its junction with the polar organ. The two envelopes then rupture here and the embryo revolves. This is a most important period in the development of the species and the time of this revolution is of great significance in understanding certain results which have been obtained by different workers.

It has been shown by Baker and Turner that an elevation of temperature before revolution is fatal to the embryo. It is also im-

[1] *Journal of Agricultural Research,* Vol. V., No. 21.

portant to remember that after the revolution of the embryo the eggs are much more susceptible to contact and similar injury. Recently Peterson[2] has published an important paper on the hatching of the eggs of these species, but he has apparently failed to note the fact that the time of revolution is extremely important in interpreting the results of experiments. It is very probable that the revolution of the embryo in New Brunswick takes place considerably later than in Washington. Judging from the conditions this would in all probability begin during the first week in April. It is evident then that in eggs taken during most of March and possibly some of those taken early in April the embryos would still be in the resting stage. Under such conditions eggs placed under a high temperature for hatching purposes would fail to hatch as all the embryos would be killed. In examining Peterson's Table I., p. 16, it will be seen that out of 4,400 eggs of *pomi* taken on March 14, not an egg hatched at 80° F., whether in dry air or in different percentages of saturation. Other eggs taken on April 6, gave a variable percentage of hatch. In dry air (expt. 105) some hatching occurred and also in 63 per cent. and 100 per cent. of moisture, but in 22 per cent. moisture (expt. 106) no hatching occurred. It seems probable that many of the embryos in the eggs used had not revolved and that more such eggs were present in experiment 106 than in experiments 105, 107 and 108. In fact these results seem to contradict Peterson's conclusion for more hatched in dry air than in 22 per cent. moisture in which there was no hatch whatever. Certainly since more hatched in dry air than in 22 per cent. moisture one can not claim that it was lack of moisture which prevented the hatch. Some other factor must have been at work and this factor was evidently the condition of the embryo.

The writer does not intend to convey the impression that moisture has no influence on the hatching of these eggs for, as Peterson indicates, it undoubtedly has but he wishes to point out the fact that in experiments of this kind the stage of embryonic development must be considered if accurate conclusions are to be drawn.

Thus the small percentage of hatch secured by Gillette in Colorado is explained by Peterson entirely on moisture conditions and yet the writer has just shown that the failure to hatch in some of Peterson's own experiments with *pomi* is due to an entirely different factor.

The hatching of the different species takes place in very much the same way although *prunifoliæ* is much earlier than *pomi* and *malifoliæ* which two hatch at approximately the same date.

After revolution of the embryo hatching can be advanced or retarded greatly by weather conditions. An elevated temperature which before this time is fatal serves afterwards to hasten hatching unless the atmosphere is extremely dry. The gelatinous matrix in which the egg is embedded has by this time become more or less brittle and splits irregularly, usually in a longitudinal direction. This is soon followed by a rupture in the shell made by the egg burster. The young nymph continues to push its way outward until it stands in an erect position just above the slit in the shell. At this time the membrane has not ruptured and the aphid sometimes dies without freeing itself. Normally, however, the membrane ruptures to the right of the egg burster and gradually works downward carrying this structure with it. The young insect then leaves the egg and this thin pellicle is left as a shrivelled structure partly protruding from the slit in the shell. In speaking of the fate of the egg burster Peterson (*l. c.*, p. 14) says: "During emergence this ridge disappears and only a faint line remains along the meson." As far as our observations go, however, the egg burster retains its identity as part of the membrane in much the same way as that of *Corydalus cornutus*, described by Riley. In some cases the writer has observed young of viviparous aphids to free themselves while on the leaf. Packard[3]

[2] New Jersey Agr. Exp. Sta. Bull. No. 332, 1919.

[3] "Text Book of Entomology," 1909, The Macmillan Co., p. 583.

has reported the casting of the amnion of *Melanopus spretus* while the nymph is free from the egg and mentions observing this condition in the hatching of several other insects. In fact, it has been observed that very many insects, including the seventeen year cicada, are entirely enclosed in this membrane after hatching.

In the aphids as the embryo revolves the serosa contracts and draws with it the cells of the polar organ and the serosa and polar organ from the dorsal plate. This then invaginates, forming the dorsal body which separates itself from the amnion completely and is ultimately absorbed. Thus only the serosa and polar organ disappear while the amnion closes the gap and remains as a distinct membrane over the embryo. This membrane separates, remains distinct, and, as previously indicated, is left behind as a thin, transparent membrane by the hatching nymph.

Headlee[4] has stated that "A third layer may be seen as the nymph hatches, but this is probably the first-cast skin of the nymph," and this view seems to be held also by Peterson (*l. c.*, p. 10) who says, "This layer is shed by the nymph as it emerges, consequently it must be an exuvium." The writer is unable to agree with this view for the exuvia cast by the nymph during its growth are quite different from this embryonic membrane which it leaves behind when hatching.

After the embryo has revolved and is proceeding toward hatching the egg is in much more critical condition than during the dormant period. It is less protected by reason of the fracture of the gelatinous matrix enclosing it and the embryo which is actively growing is more susceptible to the effect of spray solutions. This undoubtedly explains the varying results obtained by different workers in spraying experiments on aphid eggs. In many lots wherein the embryo had revolved good results were obtained, whereas in other lots where no revolution had taken place, hatching was about normal. In this connection it is important to bear in mind that *pomi* and *malifoliæ* revolve at about the same period, the middle of March in Washington, and that early in April these eggs are very susceptible to treatment with such sprays as lime sulphur. At the time these eggs are in this critical period of embryonic development those of *prunifoliæ* have hatched and the young are in the first or rarely the second instar. These young nymphs are not affected greatly by lime sulphur but are easily killed by nicotine sprays.

It seems clear therefore, than in interpreting hatching records of aphid eggs in the course of spraying or other experiments, account must be taken of the condition of the embryo in regard to revolution. Knowledge of this fact is also essential in practical control work. Thus in the case of the three apple aphids here considered, the recommendations for use of the combined lime-sulphur-nicotine spray as a "delayed dormant" treatment, is seen to be based on scientific reasons —the lime sulphur to destroy the later hatching eggs, principally *pomi* and *malifoliæ*, and the nicotine for the already hatched aphids.

A. C. BAKER

U. S. BUREAU OF ENTOMOLOGY,
WASHINGTON, D. C.

[4] New Jersey Agr. Exp. Sta. Bull. No. 328, 1918.

THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

SECTION OF CELLULOSE CHEMISTRY

Harold Hibbert, *chairman.*
G. J. Esselen, Jr., *secretary.*

Effect of adding various chemicals to wood previous to distillation: L. F. HAWLEY. Several different chemicals have been mixed with wood and the mixture distilled for the determination of the effect of the chemical on the yield of valuable products. The chemical was mixed with the sawdust by sprinkling in case it was water soluble or by mixing the solid in case it was insoluble. The mixture was then briquetted and the briquets distilled in a special retort in which mechanical pressure could be applied to the briquets during distillation. The only chemical tried which had a beneficial effect when used in reasonable quantities was sodium carbonate. When about one per cent. of sodium carbonate is mixed with wood previous to distillation the yield of methyl alcohol

is increased by about 50 per cent. The yield of acetic acid is not decreased by the sodium carbonate.

The removal of free acid from nitrated cellulose, with special reference to the use of saline leaches: S. E. Sheppard.

Motor fuel from vegetation: T. A. Boyd. The use of motor vehicles in the United States has increased very much more rapidly than the production of crude oil and considerably faster than the production of gasoline, although the volatility of gasoline has beeen decreasing from year to year. This, coupled with the fact that reserves of crude oil are being rapidly depleted, makes it essential that other sources of motor fuel be developed. Alcohol makes a desirable motor fuel, and it appears to be the most promising ally to petroleum oils for the purpose. The preparation of sufficient alcohol for motor fuel from foodstuffs does not appear to be feasible, and it seems advisable to make a further and more intensive investigation of cellulose as a source of this material.

Possibilities of the moist tropics as a source of cellulose and carbohydrates: H. N. Whitford. The subject resolves itself into three headings, (*a*) an inventory of present resources of the tropics, (*b*) growth in moist tropical forests, (*c*) bamboo and other plants as sources for cellulose and industrial alcohol. (*a*) From an economic standpoint tropical forests are not so complex as usually believed. A rough estimate of the great forested regions of South America and Asiatic tropics shows more than twice as much standing timber as in the United States. (*b*) Actual knowledge of growth of certain forest crops shows that practically the annual increment per unit area as fully stocked stands is usually more than twice that in the United States. (*c*) Heavy yields of bamboo indicate that it may be the most promising plant for the production of cellulose and possibly alcohol. Nipa palm possesses possibilities for alcohol.

The possibilities of a future fuel supply from our forests: R. C. Hawley.

The rôle of the chemist in relation to our future fuel supply: Harold Hibbert. Up to the present attention has been concentrated primarily on the production of alcohol from cellulose products. In view of the fact that in the fermentation of sugar not more than 80 per cent. of the theoretical quantity of alcohol is obtained while 50 per cent. by weight of the original material is lost in the form of carbon dioxide, it seems desirable to subject cellulose to intensive investigation with a view to ascertaining how far it is possible to convert it into other materials such as furfuraldehyde, etc., in which a better yield could possibly be obtained of a material suitable for use as a liquid fuel.

The effect of chemical reagents on the microstructure of wood: Allen Abrams. A method has been devised for treating very thin sections of wood with chemical reagents under different conditions of temperature and pressure. This method has been used in treating sections with a considerable variety of reagents, such as cellulose solvents, acids, alkalies, oxidants and chemicals used in paper-making. The effects on the microstructure of wood have been studied both by microscopic observation and by cell measurements. Some of these effects may be summarized as follows: (1) Cellulose solvents act strongly and proportionately on both the middle lamella and the cell wall. (2) Strong oxidants act on the cell wall but have little effect on the middle lamella. (3) The ordinary paper-making reagents act strongly on the middle lamella, with but relatively little visible effect on the cell wall. Whereas caustic soda solutions cause swelling of the cell wall, solutions of sodium bisulphite and sodium sulfide cause little or no swelling.

Measuring soil toxicity, acidity and basicity (cooperative work with the U. S. Dept. of Cereal Investigation): R. H. Carr. There is a close connection between an acid soil, the amount of easily soluble iron and aluminum present, and the soil's capacity to grow a good crop. A quantitative method has been developed to measure the presence of easily available iron and aluminum by extracting the dry soil with an alcoholic solution of potassium thiocyanate. A red color will develop if the soil is acid, due to the formation of ferric thiocyanate. This solution is titrated with a standard alcoholic base until the color just disappears. If no color develops the soil is neutral or basic and it may be titrated with a standard alcoholic acid, and the limestone equivalent determined. A special tube has been devised for this work.

Influence of mixed acid on the character of nitrocellulose: W. J. Waite. The vapor tension of nitric acid in the nitrating bath controls the degree of nitration of the nitrocellulose. The dehydrating value of sulphuric acid is a factor which

influences the vapor tension of the nitric acid. The hydrolyzing action of sulphuric acid in the nitrating bath sets up secondary reactions, which are responsible for variations in yield, formation of insoluble bodies, gelatinous products, and unstable esters. The solubility of nitrocellulose is determined by the dehydrating value of sulphuric acid in the nitrating bath. The nitrocelluloses used in the commercial world are divided into seven types based on their specific uses. Degree of nitration curves based on factory experience, showing the degree of nitration as a function of the actual nitric acid and the nitrating bath, indicates that, for the same degree of nitration, as the actual nitric increases a corresponding increase in the nitrating total is required in order to maintain the same molecular ratio between the water and sulphuric acid in the bath.

Some commercial possibilities of corn cob cellulose: F. B. LAFORGE. Brief outline of our process for the preparation of adhesive, furfural and cellulose from corn cobs; proposed uses of the three products. Preparation of corn cob cellulose in powder form and uses as substitute for wood flour for nitration and acetylation; preparation in the form of pulp and uses in paper manufacture. Corn stalks and husks as a source of adhesive furfural and fiber.

A color test for "remade milk": OSCAR L. EVENSON. A yellow color produced by the action of sodium hydroxide on the washed curd of milk made from milk powder, serves as a test for the presence of milk powder in natural milk. The curd precipitated from 25 c.c. of milk with acetic acid is washed and placed in a vial with 10 c.c. of 5 per cent. sodium hydroxide. Natural pasteurized milk treated in the same manner is used as a control. The color is probably due to the presence in the curd of a residue of aldehydic nature resulting from the action of heat and desiccation.

Nitro-cellulose and its solutions as applied to the manufacture of artificial leather: W. K. TUCKER. (1) Properties of the nitro-cellulose: (*a*) Degree of nitration and why lower and higher nitrations are objectionable; (*b*) viscosity; (*c*) degree of purification and the effects of the purification on viscosity; (*d*) stability; (*e*) ash. (2) Solution: (*a*) solvents and non-solvents generally used and why; (*b*) viscosity of solutions generally used. Granular and short solutions; (*c*) effect of various solvents and non-solvents on the viscosity of solutions; (*d*) proportion of nitro-cellulose in solutions generally used and short discussion of the use of solution with a larger percentage.

An experimental study of the significance of "lignin" color reactions: ERNEST C. CROKER. An investigation of the so-called color reactions showed that the following phenols gave strong red, violet or blue colors with wood of any kind when applied in strongly acid solution: phloroglucinol, orcinol, resorcinol, and pyrogallol. Likewise, all primary aromatic amines gave yellow to orange colors when applied in acid solutions of any strength. The secondary amine, diphenylamine, also gave an orange color even when highly purified and freed from traces of primary amines. Pyrrole gave a deep red color in hydrochloric acid solution. Various materials were substituted for wood, and tested with above types of reagents for color formation. It was found that only (but not all) *aromatic aldehydes* gave color reactions similar to those given by wood. Spectroscopic investigation and comparison of colors obtained showed that the principal color source of wood is not vanillin or furfural, as several writers have claimed, but a different aldehyde—possibly coniferyl aldehyde. It was found that certain natural phenols and ethers such as eugenol and safrol, which are reported as giving colors with the phenols and aldehydes, do so only because of aldehydic impurities. The Mäule test was found to give a distinct red color only in the case of deciduous woods. The test was found to be caused by a component of the wood, which after chlorination turns red when made alkaline. Apparently no color test is an indicator of *lignin,* but of traces of materials (aldehydic for most of the tests) which usually—perhaps always—accompany lignin.

A proposal for a standard cellulose to be available for research: B. JOHNSEN.

A discussion of some beater furnish reactions from the standpoint of colloidal chemistry: JESSIE E. MINOR. This discussion is based upon a series of experiments performed for the purpose of obtaining some more exact information as to the changes in the physical properties of a paper which are brought about by each addition made to the furnish. The increased strength attained by beating is due to the mucilaginous product of hydrolysis and the decrease in strength by excessive beating is due to the loss of fiber structure. Alum coats the fiber with a gelatinous layer of aluminum hydroxide and changes the electrical charge on the fiber. It thus aids in size retention as does calcium sulphate, though the latter is less effective. In-

soluble fillers which give almost no ions are still less effective. Their chief effect is to weaken the paper as do calcium chloride and sodium carbonate. Explanations for these various phenomena are given based on the modern concepts of colloid chemistry.

The solubility of cellulose acetate in chlorinated hydrocarbons: Gustavus J. Esselen, Jr. The present paper offers an explanation of the fact that cellulose acetate is soluble in certain chlorinated hydrocarbons but not in others, as for example, in chloroform but not in carbon tetrachloride. The internal pressures of the chlorinated derivatives of methane and ethane have been calculated and it is shown that the corresponding solvent action on cellulose acetate is in general what is to be expected from the relative values of the internal pressures. The fact that the addition of a little alcohol increases the solvent action of certain of the solvents in question is also shown to be in accord with what is to be expected from the accompanying change in the polar environment.

The action of dry hydrobromic acid on cellulose and related derivatives: Harold Hibbert and Harold S. Hill. The authors have reinvestigated the action of dry hydrobromic acid in chloroform solution on cellulose, viscose, dextrose, α methyl glucoside, sucrose and certain other derivatives. Higher yields of brom-methyl furfuraldehyde were obtained in the case of cellulose and viscose, while with dextrose as much as 12–15 per cent. of the crystalline product was obtained. Good yields were also obtained in the case of α methyl glucoside and other derivatives. The evidence would seem to prove that the formation of brom-methyl furfuraldehyde is no longer to be associated with the presence of a free carbonyl (keto) group in the cellulose molecule.

The oxidation of cellulose: W. S. Holzberger.

European practise in cellulose acetate and dopes during the war: Philip Drinker. (1) Cellulose acetate developments from commercial and scientific aspects. (2) Cellulose acetate solvents, non-solvents, plastics, high-boilers, etc., as developed for airplane dopes. (3) Various dope formulæ as shown by their historical development as the war progressed, the "standard forms" ultimately decided upon, etc. (4) The effect of sunlight and other agents on fabrics and means of preventing said effects with account of researches on these subjects. (5) Recovery of solvents in doping and recovery of cellulose acetate from discarded airplane fabrics.

The influence of temperature on hemi-cellulose production: W. E. Tottingham. Red clover and buckwheat plants grown at temperatures of about 15° to 18° in one case and 20° to 23° in another, in the latter case with the evaporating power of the air kept nearly the same for the two temperature ranges, have shown an increase of acid hydrolyzable material at the lower temperatures. This difference amounted to about 5 per cent. of the total dry tissue of the plant. No evidence has been obtained as yet of definite variations of the fundamental cellulose with temperature differences attending growth. It appears that the hemicellulose which would be included in the acid hydrolyzable material may form an important carbohydrate reserve in the plant economy. It is suggested that the depression of respiration in proportion to photo-synthesis at the lower temperatures may favor the accumulations of hemi-cellulose observed.

The chemical changes involved during infection and decay of wood and wood pulp: Mark W. Bray and Joseph A. Staidl. The results and significance of the determination of various constants are given on a number of samples of sound and decayed spruce woods, pulps and waterleaf papers made from them by the groundwood, sulphite and soda processes. It was found that the water soluble materials, the alkali soluble substances, the copper numbers, and the beta cellulose, increase, while the alpha and gamma cellulose constants decrease with the progress of decay, in all the woods, pulps, and papers studied. The lignin content shows an apparent percentage increase in decayed wood. If the calculations are based on the original weights of the sound wood, however, there is a slight decrease in this constant. The data given show the relation of the lignin or non-cellulose encrusting material of sound and decayed woods and pulps. Certain organisms of decay have a selective action on the constitutents of wood and wood pulp, attacking the cellulose in preference to the non-cellulose encrusting substances. Gamma cellulose is so unstable that a very small percentage was obtained in decayed woods and pulps. The losses sustained by the paper industry as a result of the use of decayed woods and pulps are pointed out.

The chemical constitution of soda and sulfite pulps from coniferous woods and their bleaching qualities: Sidney D. Wells.

Charles L. Parsons,
Secretary